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and St. Clair Counties), Alabama**

Section 6

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Abstract – Big Canoe Creek drainage in east central Alabama historically supported 36 freshwater mussel species and 21 freshwater gastropod species. Timed searches were used to assess the mussel assemblage and gastropods were collected qualitatively at 48 sites throughout the watershed. A total of 497 live mussels representing 16 species was collected over 45.4 person-hours, with an overall CPUE of 10.9 mussels/person-hour. Among these were federally protected *Hamiota altilis*, *Pleurobema decisum* and *Ptychobranhus foremanianus*. One additional mussel species was collected as fresh dead shell only, two as weathered dead only and two as relic only. Nine gastropod species were collected during the survey. The Big Canoe Creek system continues to support a high diversity of mollusks (41 species collected in the past 25 years).

Introduction

Big Canoe Creek (BCC) drainage in east central Alabama is identified as a global hotspot for aquatic biodiversity, historically supporting 36 freshwater mussels and 21 gastropod species (Williams et al. 2008; Bogan and Pierson 1993; Herod 2001; Wynn et al. 2016). Surveys over the past 25 years indicate the continued presence of at least 30 mussel species and 11 gastropod species (Williams et al. 2008; Johnson et al. 2008; Johnson P. et al 2013). Eight of 37

documented mussel species, and 10 of the 21 documented gastropod species appear extirpated from the drainage, including five federally protected and three extinct species. Five federally protected mussel species are currently extant as well as 17 mussel species endemic to the Mobile River basin (Williams et al. 2008).

Alabama has 49 separate drainages recently identified as Strategic Habitat Units (Wynn et al. 2012) for federally listed and state priority aquatic species. Recent surveys in the BCC drainage by the Geological Survey of Alabama, US Fish and Wildlife Service (USFWS), Alabama Power Company, and Alabama Department of Conservation and Natural Resources have uncovered two species thought extirpated from Alabama, *Etheostoma trisella* (Bailey and Richards, 1963) (Trispot Darter) and *Elimia capillaris* (O'Neil et al. 2009, Johnson C. et al. 2013). *Pleurobema atearni*, a mussel endemic to the BCC drainage, was only recently described. While intensive fish surveys in the basin have been ongoing since 2009, the BCC system has not been well-surveyed for mussels since 2001 and no comprehensive gastropod survey has ever been conducted.

This project completes a comprehensive survey of the mollusk fauna in the BCC drainage as part of a multifaceted effort by the Alabama Department of Conservation and Natural Resources to monitor and restore threatened and endangered mollusk resources within the state. An additional goal is to locate new brood stock sources to support propagation and reintroduction efforts and identify habitat(s) where future species reintroductions may be successful. Due to high species richness, BCC is identified as a potential location for mussel and gastropod reintroductions in the Mobile Basin Mollusk Recovery Plan (2010). Mollusk recovery through reintroduction, translocation and augmentation is a viable restoration strategy identified by the USFWS and National Marine Fisheries Service (2000).

Prior to commencement of species restoration activities, a thorough assessment of current mollusk population is necessary. Previous mollusk surveys completed between 1998 and 2016 provide additional data on current mollusk fauna (Wynn 2016). Mussel species historically inhabiting the system can be inferred from material stored in museum collections. The present study updates the freshwater mollusk inventory of the BCC and recommends priority restoration actions to improve mollusk populations within the drainage.

Site Description

The BCC is located in Blount, Etowah, Jefferson, and St. Clair counties in northeast Alabama. The river flows northeast along the southern edge of the Cumberland Plateau to the north and the Alabama Valley and Ridge to the south for 84 km to its confluence with the Coosa River on the St. Clair and Etowah County line. The lower 12.5 km of BCC is impounded by H. Neely Henry Reservoir. The river drainage encompasses 583 km² and includes four major tributaries, two of which are named Little Canoe Creek, here termed lower Little Canoe Creek (LLCC) which flows along the Etowah and St. Clair County line, and upper Little Canoe Creek (ULCC) which joins with BCC near the town of Springville. The remaining two major tributaries are Muckleroy Creek and Gulf Creek (Figure 1, Wynn 2016). Headwaters of the river system generally have narrow floodplains adjacent to forested mountains. These areas have a low residential density and land use is primarily small farms and timberlands. Lower reaches of the watershed consist of a wider river valley floodplain with a narrow riparian zone usually surrounded by pasture and row crops (Barbour 2004, Wynn 2016). Land development is currently low in the watershed, approximately six percent, and centered around the towns of Ashville, Springville, and Steele although Springville area is beginning to experience increased

growth as the Birmingham-Jefferson County population expands northeast. (Barbour 2004, Wynn 2016)

The BCC drainage has suffered habitat loss and fragmentation primarily from impoundments, erosion and sedimentation. Construction of H. Neely Henry Dam, completed by the Alabama Power Company in 1966, resulted in the loss of most of the mussel fauna and riverine habitat in the lower 12.5 km of BCC. The H. Neely Henry Dam effectively isolates the BBC from other Coosa River tributaries.

Methods

Free-flowing sections of the river were surveyed from kayaks (River Kilometer 16 – 67.5) in August and September 2017. An additional 10 km of both ULLC and LLCC, was surveyed at access points by foot. Topographical maps (US Geological Survey, 7.5 minute) and hand held Magellan Meridian Platinum global positioning system, WAAS enabled) were used for navigation and sample site location. The coordinates were verified and plotted on topographical maps using Maptech Terrain Navigator GIS software. Sampling sites selection was primarily based on stream bank and channel stability, with an effort to maintain somewhat uniform spacing among sites. Duration of sampling at a given site was determined by presence and abundance of mollusks. Searches focused on shoal areas consisting of riffles, runs, and shallow pools.

The total time spent sampling was recorded so Catch per Unit Effort (CPUE) could be calculated. This is a semi-quantitative method used for determining the number of mussels collected per person-hour (ph). This technique is reliable for estimating total species richness and

locating rare species, the primary goal of this study (Obermeyer 1998). Each site was sampled by a one or two-person crew.

Collection methods included snorkeling, visual searching and hand grubbing. We collected all mussels and representatives of all gastropod species encountered within sampling reaches, which were approximately 50-100 m in length, depending on the extent of suitable habitat at a given site. Collected mollusks were placed in mesh bags and taken to shore where mussels were identified and counted before being released and gastropods were preserved for future identification. Taxonomy followed that of Williams et al. (2017) for mussels, Johnson P. et al. (2013) for gastropods and Boschung and Mayden (2004) for fish. Mussel species considered abundant were counted *in situ* and left undisturbed in the substrate. Collecting time varied among sites and continued until it was evident that additional species were unlikely to be encountered with reasonable additional effort.

Dead shells were classified as fresh-dead (shiny nacre), weathered-dead (dull nacre, mostly intact periostracum), and relic (chalky nacre, flaky or absent periostracum). Shell material from different sites was segregated, labeled and curated at the North Carolina Museum of Natural Science in Raleigh, North Carolina.

Recorded site descriptions include date and general habitat information. Site photographs were also taken. These details are not included in this manuscript, but are on file at the Alabama Aquatic Biodiversity Center.

Results

This study encompassed 48 sites in the BCC system, with 29 in the mainstem and 19 in ULCC and LLCC combined (Tables 1 and 2, Figures 1 and 2). The mainstem survey covered 51

km (Fig. 1 and 2). Stream discharge ranged from 47 to 238 cfs for sampling trips in August and September (USGS gage station # 02401390 Ashville, Alabama, Fig. 3). A total of 497 live mussels were collected during 45.4 ph (Table 7). Overall CPUE was 10.9 mussels/ph (minimum = 0 mussels/ph, maximum = 96 mussels/ph) (Table 7). A total of 26 mollusk species was found live and/or fresh dead and all species occur in the mainstem except *Elimia carinifera* which was found only in BCC tributaries (Table 7).

The most abundant mussel species encountered was *Tritogonia verrucosa* which comprised 33.4% of the cumulative live total, followed by *Amblema elliotii* 30.6%, *Pleurobema decisum* 20.7%, and *Lampsilis ornata* 4.0%. The remaining species each comprised less than 4% in relative abundance (Table 3).

Tritogonia verrucosa was also the most widespread species, found at 39.6% of the sites sampled, followed by *A. elliotii* at 25.0%, *Villosa umbrans* at 22.9%, *P. decisum* at 20%, *L. ornata* at 18.8%, *Quadrula rumphiana* at 12.5% and *Hamiota altilis* at 10.4%. The remaining species were detected at fewer than 10% of the sites (Table 4).

Species represented by single live individuals (Table 7): *Lasmigona etowaensis*, *Pseudodontoideus connasaugaensis* and *Villosa nebulosa*. Other uncommonly encountered species, represented by ten or fewer individuals are: *H. altilis*, *Leptodea fragilis*, *Megaloniaias nervosa*, *Obliquaria reflexa*, *P. atearni*, *Ptychobranthus foremanianus*, *Q. rumphiana*, *V. umbrans* and *Villosa vibex*. *Lampsilis teres* (Rafinesque, 1820) (Yellow Sandshell, was collected only as fresh dead shell. Four species were represented by weathered dead and/or relic shells only: *Elliptio arctata*, *Lasmigona alabamensis*, *Ligumia recta* and *Utterbackia imbecillis*.

Ten sites had mussel species richness ≥ 5 live or fresh dead, and seven sites had a CPUE of ≥ 19 live mussels/ph. (Table 7). Sites with both high species richness and CPUE included

BCC sites 18, 19, 20, 25, 26 and 27. These six sites were considered the best mussel sites surveyed (Table 7).

Evidence of recent recruitment was observed for 10 species as indicated by the presence of subadult / juvenile age classes (1 - 5 annuli, ≤ 50 mm shell length for most medium to large species). Populations of abundant mussels, *A. elliotii*, *P. decisum* and *T. verrucosa* appeared healthy and comprised of several age classes, though most individuals were large adults.

Species of Conservation Concern

Of the ten federally protected mollusk species historically present in the BCC system, only three were encountered live: *H. altilis*, *P. decisum* and *P. foremanianus*. All federally protected species and candidates encountered are considered priority 1, species of highest conservation concern in Alabama (Mirarchi 2004). In addition, four mollusk species listed as high conservation priorities in the Mobile Basin Mollusk Recovery Plan were found live: *A. elliotii*, *L. etowaensis*, *P. athearni* and *P. connasaugaensis*. In the Mobile Basin Mollusk Recovery Plan, *Leptoxis foremani*, *Lioplax cyclostomaformis*, *Rhodacme elatior*, *L. recta*, *P. athearni* and *Pleurobema hanleyianum* are tier 1 species (highest priority). *Leptoxis coosaensis*, *Elliptio arca*, *E. arctata*, *Medionidus acutissimus*, *Obovaria unicolor*, *Pleurobema georgianum*, *P. foremanianus*, *P. connasaugaensis* and *Toxolasma corvunculus* are tier 2 species. *Tulotoma magnifica*, *A. elliotii*, *H. altilis*, *L. etowaensis* and *P. decisum* are tier 3 species (MBMRC 2010). Federally protected or extinct species historically found in the BCC but not collected during this survey are *Elimia laeta*, *Gyrotoma pyramidata*, *L. foremani*, *L. coosaensis*, *L. cyclostomataformiis*, *T. magnifica*, *Epioblasma metastriata*, *Epioblasma othcaloogensis*, *M. acutissimus*, *P. georgianum* and *P. hanleyianum*.

Amblema elliotii Tier 3

A total of 152 live *A. elliotii* was collected among 12 sites (Table 7). The cumulative relative abundance of *A. elliotii* was 30.6% (Table 3). Several size classes including subadults between 20 - 121 mm in length were observed which is indicative of recent recruitment and healthy populations. The species was collected live between sites 16 and 29, indicating a current distribution between ULCC and BCC confluence to Neely Henry Reservoir (Figure 3).

Elimia capillaris Federal Candidate

Elimia capillaris was collected live in low densities at three sites in lower BCC (Table 7, Figure 4). This species was previously thought extinct and was last collected in August 31, 1990 (Bogan and Pierson 1993) before being rediscovered in BCC in 2014 (APC, USFWS, ADCNR unpublished reports 2014). The BCC is the last known population of *E. capillaris*, a Coosa River endemic with a range of less than 20 km of lower BCC (Figure 4). Its limited range and low densities suggest that it is vulnerable to extinction.

Hamiota altilis Federally Threatened

A total of six live *H. altilis* were collected among five sites (Table 7). The cumulative relative abundance of *H. altilis* was 1.2% (Table 3) and the sizes of live individuals were 27, 78, 81, 84, 92 and 99 mm in length. The observation of one subadult animal is a positive sign although a low abundance remains a cause for conservation concern. *Hamiota altilis* was collected live and distributed between sites 10 and 15 including the lower end of ULCC (Figure 5).

Lasmigona etowaensis Tier 3

Only one live individual of this headwater species was collected (Table 7, Figure 6). The size of the individual was 34 mm in length. The last record of *L. etowaensis* from the BCC was in the early 1970's from LLCC, (Hurd 1974). The current survey indicates that *L. etowaensis* remains extant in the BCC but in low numbers and apparently isolated to small headwaters in the system.

Ligumia recta Tier 1

Only relic shell at two sites was collected during this survey (Table 7). Live individuals of *L. recta* were collected in 2003 and 2014 (Gangloff 2003 in Wynn et al 2016; McGregor and Garner 2004). The decline of this species throughout the Mobile River system is attributed to the loss of its host fish *Stizostedion vitreum* (Walleye) (see Discussion).

Pleurobema athearni Federal Candidate

A total of 10 live *P. athearni* was collected among 3 sites, fresh dead at one site and relic at 8 sites (Table 7, Figure 7). The cumulative relative abundance of *P. athearni* was 2.0% (Table 3) and the sizes of live individuals were 61, 68, 69, 70, 71, 85, 86, 91, 92 and 97 mm in length. Previously believed to be restricted to a few sites in BCC proper and in ULCC, this survey re-extended the current known range of *P. athearni* to LLCC, though it remains very rare. Less than 15 live individuals of *P. athearni* have been collected in the past 25 years from five sites including two in ULCC and three in BCC proper. It is notable that the two sites with live *P. athearni* in this survey were new isolated and remote sites. Revisits to past sites where *P. athearni* had been recently collected live within the past 25 years only recovered one fresh dead shell and relic

shells. The low abundance and absence of sub adults (SL < 50 mm) in the present survey suggests a continued species decline.

Pleurobema decisum Federally Endangered

A total of 103 live *P. decisum* was collected among 10 sites in lower half of BCC between sites 19 - 29 downstream of South Fork of Dry Creek and BCC confluence (Table 7, Figure 8). The cumulative relative abundance of *P. decisum* was 20.7% and the size range of live individuals was 26 - 77 mm in length. Several size classes including subadults were observed which is indicative of recent recruitment and healthy populations.

Pseudodontoideus connasaugaensis Tier 2

Only one old live individual of this headwater species was collected (Table 7, Figure 9). The size of the individual was 84 mm in length. The most recent BCC records of *P. connasaugaensis* in the past 25 years were reported as weathered dead shell from ULCC (McGregor 2009). Hurd (1974) collected live specimens in LLCC in the early 1970's. Although historically never an abundant species, examples of current Coosa River tributaries with healthy reproducing populations like Shoal Creek in Cherokee County, Alabama, suggest that small headwater streams can support much higher numbers than are currently present in BCC.

Ptychobranhus. foremanianus Federally Endangered

A total of two live *P. foremanianus* was collected between two sites (Table 7, Figure 10). The cumulative relative abundance of *P. foremanianus* was 0.4% and the sizes of live individuals were 58 and 66 mm in length. There are only three additional records of live *P. foremanianus* (Feminella and Gangloff 2000 and Gangloff and

Feminella 2007 in Wynn et al 2016; McGregor and Garner 2004) in BCC proper and ULCC in the last 25 years. The low number and old age of the *P. foremanianus* found in the present survey and over the past 25 years suggests that the BCC population continues to persist but remains endangered of extirpation.

Discussion and Summary

The first unionid mollusks collected from the rivers of the Mobile Basin were taken during the early 1800's. Many of these specimens were utilized in the descriptions of new species by Issac Lea and Timothy A. Conrad (Williams, 1982). In 1876, James Lewis (1876) published a report on the mollusk fauna of Alabama River tributaries which listed species in the Mobile River system but not specific to BCC. Herbert H. Smith (1914) and Clench and Archer (1932) summarized early mollusk records from the middle and upper Coosa River which included a few sites within BCC. Herbert D. Athearn (1964, 1970, 2000), Thompson (2000), and Hurd (1974) visited several BCC system sites from 1953 - 1973, documenting 28 mussel species and 11 snail species (Table 5).

Out of 54 species of mussels and 85 species of snails known to occur in the Coosa River system and its tributaries; 37 mussel species and 21 species of snails, approximately 42%, are known from the BCC drainage (Williams et al 2008, Johnson et al. 2008; Johnson P. et al 2013). The 30 mussel species recently documented from BCC and 11 snail species ranks the watershed among those with the highest remaining mollusk diversity in the Coosa drainage (Table 5 and 6). For comparison, Terrapin Creek, another Coosa River tributary located in northeast Alabama, historically held 23 mussel species and 15 snail species, and continues to support 14 mussel species and 12 snail species (Johnson et al. 2008, Johnson P. et al 2013). The Conasauga River,

another Coosa tributary located in southeast Tennessee and northwest Georgia and known for its diverse mollusk fauna, historically supported 38 mussel species and 19 snail species. The Conasauga River currently supports 29 mussel species and 17 snail species (Johnson et al. 2008). The BCC mussel assemblage includes at least five federally protected species (Wynn et al 2016; Williams et al 2008). This unique mollusk fauna is globally significant, including the only known and remaining populations of *P. atearni* and *E. capillaris* and one of the best remaining populations of *P. decisum* (Hartfield 2008).

The BCC mussel fauna remains diverse and relatively healthy, but some species are healthier than others. Recent recruitment and smaller size classes of mussels measured suggest healthy populations observed for several species, including federally protected *H. altilis*, and *P. decisum* (Table 7). In contrast three species historically in BCC, *P. georgianum*, *P. hanleyianum*, and *P. foremanianus* have been eliminated from much of their former ranges and are among species considered in the MBMRC (2010). They currently occur in the BCC but in low numbers and primarily of larger adult size ranges with no evidence of recent recruitment (Wynn et al 2016).

Mollusk species reported live from the BCC drainage within the last 25 years (Wynn et al 2016) that were not found during this survey are presented in Table 5 and 6 include:

Micromenetus dilatatus, *Pseudosuccinea columella*, *E. arca*, *E. arctata*, *E. crassidens*, *L. recta*, , *P. georgianum*, *P. hanleyianum*, *T. corvunculus*, *T. donaciformis* and *U. suborbiculata*. Recent surveys within the past 25 years have recorded these species live in the BCC suggesting that they still occur at very low densities or unique micro habitats (Wynn et al 2016). Some of these species may have been missed in the present survey for particular reasons. Of the two snails reported from recent surveys but not encountered during the present one, *Micromenetus dilatatus*

is very small, easily overlooked, and may be seasonally uncommon, and *Pseudosuccinea columella* generally prefers more lotic habitats than were mostly covered during this survey. Habitat preference of *E. arctata* indicates they can prefer deep water under large rocks and boulders. No SCUBA was used during this survey so deep-water habitats were not sampled. One species, *T. donaciformis*, is more commonly found in large rivers or reservoirs so the historical BCC occurrences were likely ephemeral. *Utterbackia suborbiculata* historically did not occur in the Mobile Basin. It's an invasive mussel introduced into the basin likely through the release of infected host fish. Loss of host fish is attributed to the continued decline of *L. recta* in the Mobile River Basin which utilize *Stizostedion vitreum* (Walleye). Walleye in the Mobile River Basin are considered a genetically distinct population (Billington and Strange 1995; Billington and Maceina 1997) and have had significant declines due to habitat loss and fish passage barriers (Billington and Maceina 1997). Another species whose decline is attributed to host fish loss is *E. crassidens*, which was historically common in the Coosa River and its large tributaries. The only host fish reported for *E. crassidens* is the anadromous *Alosa chrysochloris* (Skipjack Herring) and the former has declined in numbers and its age structure has been skewed to older individuals since the Coosa River was impounded and there is no fish passage at the dams (Williams et al. 2008). *Toxolasma corvunculus* is a small mussel and generally uncommon so could have easily been overlooked.. This species could have been missed due to limited search time in its primary habitat of small headwaters and tributaries. *P. georgianum**, *P. hanleyianum* have been declining in numbers throughout their range since the early 1900's. Only single live specimens have been found at BBC sites in the last 25 years. Thus, of all species reported from the BCC in the last 25 years but not encountered during this survey, the possibility exists that all are still extant but rare.

A portion of the historically documented BCC mollusk fauna has not been found during surveys of the past 25 years. Loss of habitat and fragmentation created by impoundments is the leading cause of decline and extinction of North American mollusk species (Vaughn and Taylor 1999). Habitat loss is attributed to the possible extirpation of 8 mussel and 10 snail species from BCC within the past 45 years (Williams et al. 2008)(Table 5 and 6). Species that remain common and widespread in the Mobile River Basin but not reported in recent BCC surveys include: *Cyclonaias asperata*, *Fusconaia cerina*, *Lampsilis straminea*, and *Villosa lienosa* (Table 5). Also absent from recent BCC surveys are *Medionidus acutissimus* and *Obovaria unicolor*, which are state wide species of conservation concern with declining numbers throughout their ranges. Four species are now considered extinct, the snails *Elimia laeta* and *Gyrotoma pyramidata*, and the mussels *Epioblasma metastriata* and *Epioblasma othcaloogensis* (Williams et al 2008; Johnson et al. 2008, Johnson P. et al 2013).

In summary, the BCC drainage remains home to a diverse, globally significant freshwater mollusk assemblage, despite the loss of major faunal components due to habitat alteration and poor land use practices. However, if past habitat perturbations can diminish over time and conservation programs can work to accelerate land use improvements, mollusk species diversity and abundance may be maintained and even increased. Also, great strides have been made in techniques for captive propagation of mussels and the Alabama Department of Conservation and Natural Resources has made a large investment in a facility dedicated to that purpose. With these recent developments taken into account, protection of the remaining mussel assemblage appears promising and restoration of its extirpated fauna is a real possibility.

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Table 1. Big Canoe Creek site number code, locality and latitude/longitude coordinates for sites sampled during summer 2017 in St. Clair County and Etowah County, Alabama.

Site	Locality	Map coordinates
01	Big Canoe Cr., 0.06 km upstream Canoe Cr. Rd.	N 33.79304°, W -86.51782°
02	Big Canoe Cr., 0.83 km downstream Canoe Cr. Rd.	N 33.79550°, W -86.51021°
03	Big Canoe Cr., 1.48 km downstream Canoe Cr. Rd.	N 33.79655°, W -86.50683°
04	Big Canoe Cr., 0.94 km upstream Co. Rd. 9	N 33.79779°, W -86.49471°
05	Big Canoe Cr., 4.11 km downstream Co. Rd. 9	N 33.80444°, W -86.45581°
06	Big Canoe Cr., 4.59 km downstream Co. Rd. 9	N 33.80412°, W -86.45081°
07	Big Canoe Cr., 2.3 km upstream Co. Rd. 23	N 33.80211°, W -86.43794°
08	Big Canoe Cr., 1.92 km upstream Co. Rd. 23	N 33.80396°, W -86.43441°
09	Big Canoe Cr., 0.24 km upstream Co. Rd. 23	N 33.80376°, W -86.42109°
10	Big Canoe Cr., downstream Co. Rd. 23	N 33.80434°, W -86.41934°
11	Big Canoe Cr., 2.83 km upstream US Hwy 11	N 33.82046°, W -86.39572°
12	Big Canoe Cr., 0.69 km downstream US Hwy 11	N 33.80910°, W -86.37725°
13	Big Canoe Cr., 0.96 km downstream of Interstate 59	N 33.79538°, W -86.36565°
14	Big Canoe Cr., 1.44 km downstream of Interstate 59	N 33.79440°, W -86.36189°
15	Big Canoe Cr., 2.06 km upstream Co. Rd. 31	N 33.78905°, W -86.34933°
16	Big Canoe Cr., 0.67 km upstream Co. Rd. 31	N 33.79464°, W -86.33949°
17	Big Canoe Cr., 1.87 km downstream Co. Rd. 31	N 33.80987°, W -86.32980°
18	Big Canoe Cr., 3.1 km downstream Co. Rd. 31	N 33.80928°, W -86.31862°
19	Big Canoe Cr., 6.65 km downstream Co. Rd. 31	N 33.82492°, W -86.29340°
20	Big Canoe Cr., 1.14 km upstream Co. Rd. 36	N 33.82385°, W -86.28198°
21	Big Canoe Cr., 0.66 km downstream Co. Rd. 36	N 33.83615°, W -86.28333°
22	Big Canoe Cr., 2.13 km downstream Co. Rd. 36	N 33.84169°, W -86.27253°
23	Big Canoe Cr., 0.83 km upstream US Hwy 231	N 33.83699°, W -86.26379°
24	Big Canoe Cr., 0.2 km downstream Hwy 231	N 33.84159°, W -86.26104°
25	Big Canoe Cr., 0.67 km downstream US Hwy 231	N 33.84447°, W -86.26144°
26	Big Canoe Cr., 0.69 km downstream Double Bridge Rd.	N 33.84666°, W -86.24739°
27	Big Canoe Cr., 3.75 km downstream Double Bridge Rd.	N 33.86258°, W -86.24422°
28	Big Canoe Cr., 6.73 km downstream Double Bridge Rd.	N 33.87165°, W -86.22979°
29	Big Canoe Cr., 8.94 km downstream Double Bridge Rd.	N 33.86994°, W -86.21886°

Table 1 cont. Big Canoe Creek site number code, locality and latitude/longitude coordinates for sites sampled during summer 2017 in St. Clair County and Etowah County, Alabama.

Site	Locality	Map coordinates
30	Spring tributary to Big Canoe Cr., Bradford Rd.	N 33.78346°, W -86.48480°
31	Little Canoe Cr., Springville Water Treatment Hwy 174	N 33.76754°, W -86.45530°
32	Little Canoe Cr., 1 km upstream St. Clair Corr. Facility Rd.	N 33.73056°, W -86.38807°
33	Little Canoe Cr., 0.51 km upstream St. Clair Corr. Facility	N 33.73383°, W -86.38459°
34	Little Canoe Cr., St. Clair Correctional Facility Rd.	N 33.73720°, W -86.37884°
35	Little Canoe Cr., 0.5 km downstream St Clair Corr. Facility	N 33.73885°, W -86.37572°
36	Little Canoe Cr., 0.75 km upstream Co. Rd. 23	N 33.76076°, W -86.37865°
37	Little Canoe Cr., 0.25 km upstream Co. Rd. 23	N 33.76717°, W -86.37365°
38	Little Canoe Cr., 0.08 km downstream Beulah Circle	N 33.78060°, W -86.36177°
39	Little Canoe Cr., 1.39 km downstream Beulah Circle	N 33.78257°, W -86.36050°
40	Little Canoe Cr., 2.43 km downstream Beulah Circle	N 33.78696°, W -86.35620°
41	Little Canoe Cr., 0.08 km upstream US Hwy 11	N 33.96966°, W -86.17823°
42	Little Canoe Cr., 0.25 km upstream railroad crossing	N 33.96589°, W -86.17134°
43	Little Canoe Cr., railroad crossing downstream US Hwy 11	N 33.96421°, W -86.17015°
44	Little Canoe Cr., 1.08 km downstream railroad crossing	N 33.95753°, W -86.16726°
45	Little Canoe Cr., 0.5 km upstream Interstate 59	N 33.94888°, W -86.16615°
46	Little Canoe Cr., Interstate 59	N 33.94429°, W -86.16630°
47	Little Canoe Cr., 0.5 km downstream Interstate 59	N 33.94141°, W -86.16732°
48	Little Canoe Cr., Steele Station Rd.	N 33.93213°, W -86.16650°

Table 2. River discharge and gage height data during sampling dates (USGS gage station # 02401390 Big Canoe Creek near Ashville, AL)

Date Sampled	Discharge, cfs (mean)	Gage Height, feet (mean)
08/08/17	74	2.19
08/14/17	238	3.44
08/15/17	180	3.24
08/16/17	156	2.94
08/17/17	134	2.81
08/22/17	69	2.09
08/23/17	64	2.03
08/24/17	60	1.98
08/28/17	48	1.80
08/29/17	47	1.78
09/19/17	77	2.20
09/26/17	53	1.88
09/27/19	50	1.84

Table 3. Big Canoe Creek overall species abundance. (*) indicates federally protected species

Species	# Collected	% Abundance
<i>Tritogonia verrucosa</i>	166	33.4%
<i>Amblema elliotii</i>	152	30.6%
<i>Pleurobema decisum</i> *	103	20.7%
<i>Lampsilis ornata</i>	20	4.0%
<i>Pleurobema athearni</i>	10	2.0%
<i>Villosa umbrans</i>	7	1.4%
<i>Villosa vibex</i>	7	1.4%
<i>Hamiota altilis</i> *	6	1.2%
<i>Leptodea fragilis</i>	6	1.2%
<i>Obliquaria reflexa</i>	6	1.2%
<i>Quadrula rumphiana</i>	6	1.2%
<i>Megaloniaias nervosa</i>	3	0.6%
<i>Ptychobranchnus foremanianus</i> *	2	0.4%
<i>Lasmigona etowaensis</i>	1	0.2%
<i>Pseudodontoideus connasaugaensis</i>	1	0.2%
<i>Villosa nebulosa</i>	1	0.2%
<i>Lampsilis teres</i>	FD	
<i>Lasmigona alabamensis</i>	WD	
<i>Utterbackia imbecillis</i>	WD	
<i>Elliptio arctata</i>	R	
<i>Ligumia recta</i>	R	

Table 4- Species site distribution of live and fresh dead mussels from Big Canoe Creek. (*) indicates federally protected species

Species	# Sites	% Sites
<i>Tritogonia verrucosa</i>	19	39.6%
<i>Amblema elliottii</i>	12	25.0%
<i>Villosa umbrans</i>	11	22.9%
<i>Pleurobema decisum</i> *	10	20.8%
<i>Lampsilis ornata</i>	9	18.8%
<i>Quadrula rumphiana</i>	6	12.5%
<i>Hamiota altilis</i> *	5	10.4%
<i>Leptodea fragilis</i>	4	8.3%
<i>Obliquaria reflexa</i>	4	8.3%
<i>Pleurobema atearnii</i>	4	8.3%
<i>Villosa vibex</i>	3	6.3%
<i>Lampsilis teres</i>	2	4.2%
<i>Megalonaias nervosa</i>	2	4.2%
<i>Ptychobranthus foremanianus</i> *	2	4.2%
<i>Lasmigona etowaensis</i>	1	2.1%
<i>Pseudodontoideus connasaugaensis</i>	1	2.1%
<i>Villosa nebulosa</i>	1	2.1%
<i>Lasmigona alabamensis</i>	0	0.0%
<i>Utterbackia imbecillis</i>	0	0.0%
<i>Elliptio arcata</i>	0	0.0%
<i>Ligumia recta</i>	0	0.0%

Table 5. Historical mussel species documentation and Big Canoe Creek survey comparisons Historical species (1911-2008) from Williams et al (2008), Athearn (1964, 1970, 2000), Hurd (1974), Recent Surveys (1998-2016) includes Alabama Natural Heritage Database (collection data) from: Feminella (1998 unpublished survey data), Godwin and Shelton (1999 unpublished survey data), Gangloff (2003), McGregor and Garner (2004), Gangloff and Feminella (2007), , Fobian and Buntin (2010 unpublished survey data) Alabama Power and ADCNR (2014 unpublished survey data), Mason (2016 unpublished survey data) Wynn et al (2016) and Present Survey (2017). (X)=indicates extinct, (*)= indicates federally protected species, (UR)= indicates under review for federal protection.

Species	Williams et al 2008 (1911-2008)	Athearn & Hurd (1953-1973)	Recent Surveys (1998-2017)
<i>Amblema elliottii</i> (Coosa Fiveridge, Lea 1856)	X	X	X
<i>Cyclonaias asperata</i> (Alabama Orb, Lea 1861)	X	X	
<i>Elliptio arca</i> (Alabama Spike, Conrad 1834)	X	X	X
<i>Elliptio arctata</i> (Delicate Spike, Conrad 1834)	X	X	X
<i>Elliptio crassidens</i> (Elephantear, Lamarck 1819)	X	X	X
<i>Epioblasma metastrata</i> X (Upland Combshell, Conrad 1838)	X		
<i>Epioblasma othcaloogensis</i> X (Southern Acornshell, Lea 1857)	X	X	
<i>Fusconaia cerina</i> (Gulf Pigtoe, Conrad 1838)	X		
<i>Hamiota altilis</i> * (Finelined Pocketbook, Conrad 1834)	X	X	X
<i>Lampsilis ornata</i> (Southern Pocketbook, Conrad 1835)	X	X	X
<i>Lampsilis straminea</i> (Southern Fatmucket, Conrad 1834)	X	X	
<i>Lampsilis teres</i> (Yellow Sandshell, Rafinesque 1820)	X		X
<i>Lasmigona alabamensis</i> (Alabama Heelsplitter, Clarke 1985)	X	X	X
<i>Lasmigona etowaensis</i> (Etowah Heelsplitter, Conrad 1849)	X		X
<i>Leptodea fragilis</i> (Fragile Papershell, Rafinesque 1820)	X	X	X
<i>Ligumia recta</i> (Black Sandshell, Lamarck 1819)	X	X	X
<i>Medionidus acutissimus</i> * (Alabama Moccasinshell, Lea 1831)	X	X	
<i>Megalonaias nervosa</i> (Washboard, Rafinesque 1820)	X		X
<i>Obliquaria reflexa</i> (Threehorn Wartyback, Rafinesque 1820)	X		X
<i>Obovaria unicolor</i> (Alabama Hickorynut, Lea 1845)	X	X	
<i>Pleurobema athearnii</i> UR (Canoe Creek Clubshell, Gangloff, Williams and Feminella 2006)	X	X	X
<i>Pleurobema decisum</i> * (Southern Clubshell, Lea 1831)	X	X	X
<i>Pleurobema georgianum</i> * (Southern Pigtoe, Lea 1841)	X	X	X
<i>Pleurobema hanleyianum</i> * (Georgia Pigtoe, Lea 1852)	X	X	X
<i>Pseudodontoideus connasaugaensis</i> (Alabama Creekmussel, Lea 1858)	X	X	X
<i>Ptychobranthus foremanianus</i> * (Rayed Kidneyshell, Lea 1842)	X	X	X
<i>Pyganodon grandis</i> (Giant Floater, Say 1829)	X		X
<i>Quadrula rumphiana</i> (Ridged Mapleleaf, Lea 1852)	X	X	X
<i>Toxolasma corvunculus</i> (Southern Purple Lilliput, Lea 1868)	X	X	X
<i>Tritogonia verrucosa</i> (Pistolgrip, Rafinesque 1820)	X	X	X
<i>Truncilla donaciformis</i> (Fawnsfoot, Lea 1828)	X		X
<i>Utterbackia imbecillis</i> (Paper Pondshell, Say 1829)	X	X	X
<i>Utterbackiana suborbiculata</i> (Flat Floater, Say 1831)			X
<i>Villosa lienosa</i> (Little Spectaclecase, Conrad 1834)	X	X	
<i>Villosa nebulosa</i> (Alabama Rainbow, Conrad 1834)	X	X	X
<i>Villosa umbrans</i> (Coosa Creekshell, Lea 1857)	X	X	X
<i>Villosa vibex</i> (Southern Rainbow, Conrad 1834)	X	X	X
SPECIES TOTAL (L, FD, WD, R)	36	28	30

Table 6. Historical gastropod species documentation and Big Canoe Creek survey comparisons Historical species (1911-1975) from H.H. Smith (1913), Clench and Archer (1932), Athearn (1964, 1970, 2000) and Thompson (2000). Recent Surveys (1998-2016) includes Alabama Natural Heritage Database (collection data) from: Bogan and Pierson (1993), McGregor and Garner (2004), Fobian and Buntin (2010 unpublished survey data), Johnson P. et al (2013), Alabama Power and ADCNR (2014 unpublished survey data), Wynn et al (2016) and Present Survey (2017). (X)=indicates extinct, (*)= indicates federally protected species, (UR)= indicates under review for federal protection.

Species	H.H. Smith 1913, Clench & Archer 1932	Athearn & Thompson (1953-1975)	Recent Surveys (1990-2017)
<i>Campeloma regulare</i> (Cylinder Campeloma, Lea 1841)	X	X	X
<i>Elimia bellula</i> UR (Yellowleaf Elimia, Lea 1861)	X		
<i>Elimia capillaris</i> (Spindle Elimia, Lea 1861)	X	X	X
<i>Elimia carinifera</i> (Sharp-crest Elimia, Lamarck 1822)	X		X
<i>Elimia carinocostata</i> (Fluted Elimia, Lea 1854)	X	X	X
<i>Elimia laeta</i> X (Ribbed Elimia, Jay 1839)	X		
<i>Elimia modesta</i> (Coldwater Elimia, Lea 1845)	X	X	X
<i>Elimia lecontiana</i> (Rippled Elimia, Lea 1841)	X	X	
<i>Gyrotoma pyramidatum</i> X (Pyramid Slitshell, Shuttleworth, 1845)		X	
<i>Laevapex fuscus</i> (Dusky Acylid, Adams 1841)			X
<i>Leptoxis foremani</i> * (Interrupted Rockgastropod, Lea 1843)	X	X	
<i>Leptoxis coosaensis</i> * (Painted Rockgastropod, Lea, 1861)	X		
<i>Lioplax cyclostomataformis</i> * (Cylindrical Lioplax, Lea 1841)	X	X	
<i>Micromenetus dilatatus</i> (Bugle Sprite, Gould 1841)	X		X
<i>Physella</i> sp.(Physa)			X
<i>Pleurocera</i> sp. cf. <i>vestita</i> (Brook Horngastropod, Conrad 1834)	X	X	X
<i>Pseudosuccinea columella</i> (Mimic Lymnaea, Say 1817)			X
<i>Rhodacmea elatior</i> (Domed Ancyloid, Anthony 1855)	X		
<i>Somatogyrus</i> sp.(Pebblegastropod)	X		X
<i>Tulotoma magnifica</i> * (Tulotoma, Conrad 1834)	X	X	
<i>Valvata</i> sp. (Valvata)	X		
Species Total (L)	17	10	11

Table 7. Summary of Big Canoe mussel collections. Includes species collected at each site, search time, catch per unit effort, and species richness. (UL) indicates Upper Little Canoe Creek, (LL) indicates Lower Little Canoe Creek, (SP) indicates Spring Tributary, (*)= indicates federally protected species, (UR)= indicates under review for federal protection., (JV) indicates subadults observed, 1-5 annuli, ≤50 mm shell length

Species	Site (BCC)	1	2	3	4	5	6	7	8
<i>Amblema elliotii</i> (JV)									
<i>Elliptio arcata</i>									
<i>Hamiota altilis</i> *(JV)									
<i>Lampsilis ornata</i> (JV)									
<i>Lampsilis teres</i>									
<i>Lasmigona</i> □ <i>alabamensis</i>									
<i>Lasmigona etowaensis</i> (JV)		1							
<i>Leptodea fragilis</i> (JV)									
<i>Ligumia recta</i>									
<i>Megaloniaias nervosa</i>									
<i>Obliquaria reflexa</i> (JV)									
<i>Pleurobema atearni</i> (UR)									
<i>Pleurobema decisum</i> *(JV)									
<i>Pseudodontoideus connasaugaensis</i>			1						
<i>Ptychobranthus foremanianus</i> *									
<i>Quadrula rumphiana</i>									
<i>Tritogonia verrucosa</i> (JV)									
<i>Utterbackia imbecillis</i>					WD				
<i>Villosa nebulosa</i> (JV)									
<i>Villosa umbrans</i> (JV)		1	1	1		FD	1		2
<i>Villosa vibex</i>						FD	FD		
<i>Campeloma regulare</i>									
<i>Elimia capillaris</i>									
<i>Elimia carinifera</i>									
<i>Elimia carinocostata</i>		L	L		L	L		L	L
<i>Elimia modesta</i>		L	L		L	L		L	L
<i>Laevapex fuscus</i>									
<i>Physella</i> sp.									
<i>Pleurocera</i> sp. cf. <i>vestita</i>									L
<i>Somatogyrus</i> sp.									
Search Time (person hours)		2	0.8	0.8	0.8	0.5	1.0	0.5	0.8
Total number of mussels		2	2	1	0	0	1	0	2
CPUE		1.0	2.7	1.3	0.0	0.0	1.0	0.0	2.7
Total mussel species(L,FD)		2	2	1	0	2	2	0	1
Total gastropod species (L,FD)		2	2	0	2	2	0	2	2
Historic species(L, FD, WD, & R)		4	4	1	3	4	2	2	3

Table 7 cont.

Species	Site (BCC)	9	10	11	12	13	14	15	16
<i>Amblema elliotii</i> (JV)									FD
<i>Elliptio arcata</i>									
<i>Hamiota altilis</i> *(JV)			1						1
<i>Lampsilis ornata</i> (JV)					WD	1			
<i>Lampsilis teres</i>									
<i>Lasmigona alabamensis</i>									
<i>Lasmigona etowaensis</i> (JV)									
<i>Leptodea fragilis</i> (JV)									
<i>Ligumia recta</i>									
<i>Megalonaias nervosa</i>									
<i>Obliquaria reflexa</i> (JV)									
<i>Pleurobema atearni</i> (UR)			FD				8		1
<i>Pleurobema decisum</i> *(JV)									
<i>Pseudodontoideus connasaugaensis</i>									
<i>Ptychobranchus foremanianus</i> *			1						WD
<i>Quadrula rumphiana</i>									
<i>Tritogonia verrucosa</i> (JV)						1	2		
<i>Utterbackia imbecillis</i>									
<i>Villosa nebulosa</i> (JV)			1						
<i>Villosa umbrans</i> (JV)									
<i>Villosa vibex</i>			7						
<i>Campeloma regulare</i>		L	L	L					
<i>Elimia capillaris</i>									
<i>Elimia carinifera</i>									
<i>Elimia carinocostata</i>		L	L	L	L	L			
<i>Elimia modesta</i>		L	L	L	L	L	L	L	
<i>Laevapex fuscus</i>									
<i>Physella</i> sp.					L				
<i>Pleurocera</i> sp. cf. <i>vestita</i>		L	L	L	L	L	L	L	
<i>Somatogyrus</i> sp.									
Search Time (person hours)		0.5	3.0	0.5	1.5	1.2	1.2	0.5	1.0
Total number of mussels		0	10	0	0	2	10	0	2
CPUE		0.0	3.3	0.0	0.0	1.7	8.6	0.0	2.0
Total mussel species(L,FD)		0	5	0	0	2	2	0	3
Total gastropod species (L,FD)		4	4	4	4	3	2	2	0
Historic species(L, FD, WD, & R)		4	9	4	5	5	4	2	4

Table 7 cont.									
Species	Site (BCC)	17	18	19	20	21	22	23	24
<i>Amblema eliottii</i> (JV)		1	1	9	4	1	1	1	
<i>Elliptio arcata</i>									
<i>Hamiota altilis</i> *(JV)			1						
<i>Lampsilis ornata</i> (JV)			2	1		1	3	2	
<i>Lampsilis teres</i>									
<i>Lasmigona alabamensis</i>									
<i>Lasmigona etowaensis</i> (JV)									
<i>Leptodea fragilis</i> (JV)			1	3			WD		
<i>Ligumia recta</i>									
<i>Megaloniaias nervosa</i>									
<i>Obliquaria reflexa</i> (JV)							WD	1	
<i>Pleurobema atearni</i> (UR)			R						
<i>Pleurobema decisum</i> *(JV)			R	1	10	14	10	3	
<i>Pseudodontoideus connasaugaensis</i>									
<i>Ptychobranchus foremanianus</i> *					1				
<i>Quadrula rumphiana</i>		1	R	WD	1	R			
<i>Tritogonia verrucosa</i> (JV)		15	20	30	10	4	15	4	
<i>Utterbackia imbecillis</i>									
<i>Villosa nebulosa</i> (JV)									
<i>Villosa umbrans</i> (JV)									
<i>Villosa vibex</i>									
<i>Campeloma regulare</i>									
<i>Elimia capillaris</i>								L	L
<i>Elimia carinifera</i>									
<i>Elimia carinocostata</i>		L	L			L			
<i>Elimia modesta</i>		L	L	L	L	L	L	L	L
<i>Laevapex fuscus</i>				L				L	L
<i>Physella</i> sp.								L	
<i>Pleurocera</i> sp. cf. <i>vestita</i>		L	L	L	L	L	L	L	L
<i>Somatogyrus</i> sp.				L				L	L
Search Time (person hours)		1.0	1.2	0.7	1.0	1.5	1.5	1.2	0.3
Total number of mussels		17	25	44	26	20	29	11	0
CPUE		17.0	21.4	66.0	26.0	13.3	19.3	9.4	0.0
Total mussel species(L,FD)		3	5	5	5	4	4	5	0
Total gastropod species (L, FD)		3	3	4	2	3	2	6	5
Historic species(L, FD, WD, & R)		6	11	10	7	8	8	11	5

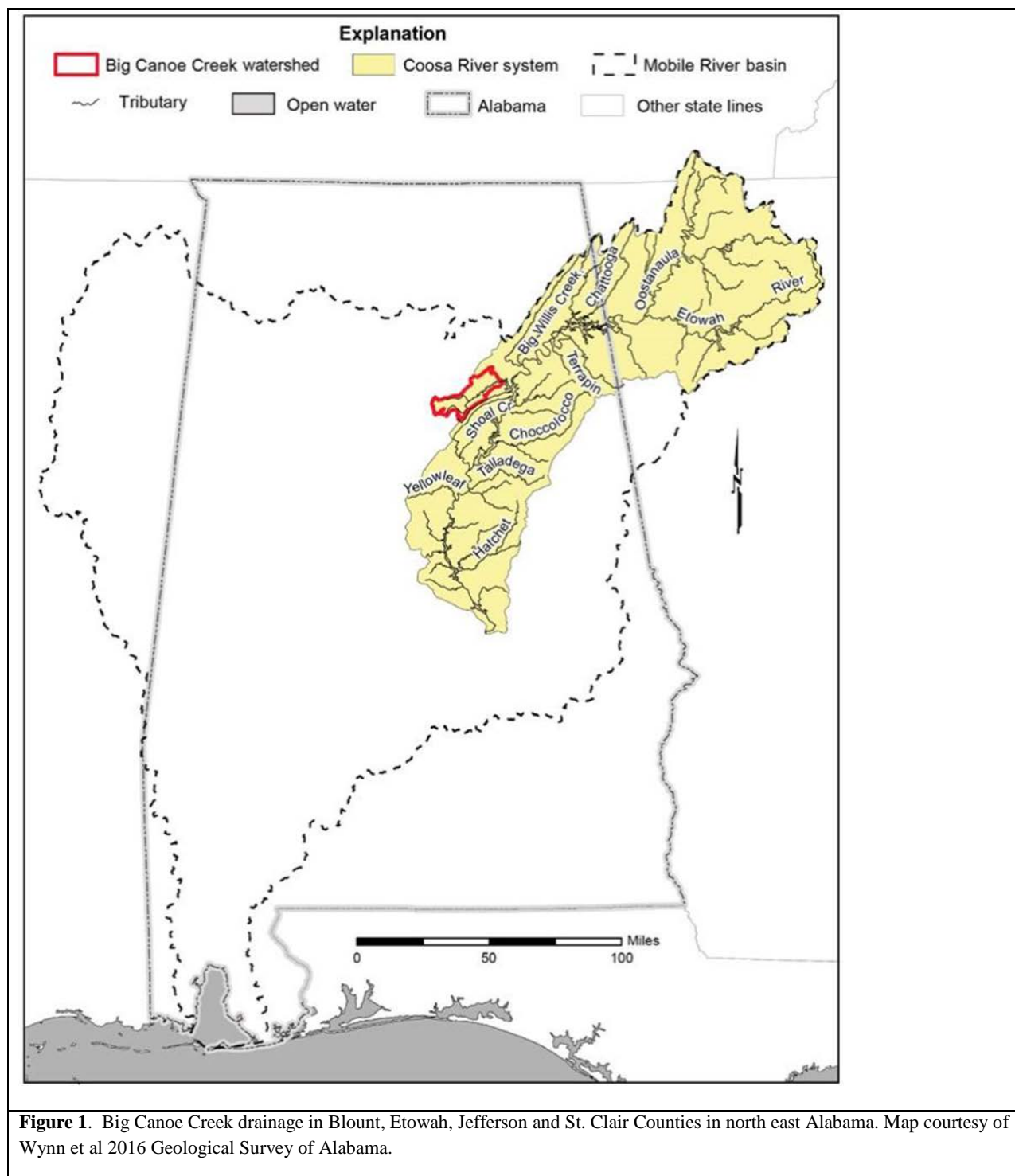
Table 7 cont.									
Species	Site (BCC)	25	26	27	28	29	ST30	UL31	UL32
<i>Amblema elliotii</i> (JV)		17	35	79		3			
<i>Elliptio arctata</i>		R?							
<i>Hamiota altilis</i> *(JV)									
<i>Lampsilis ornata</i> (JV)		9	1	R	FD	WD			
<i>Lampsilis teres</i>				FD	FD				
<i>Lasmigona alabamensis</i>						WD			
<i>Lasmigona etowaensis</i> (JV)									
<i>Leptodea fragilis</i> (JV)		2	FD						
<i>Ligumia recta</i>		R				R			
<i>Megalonaias nervosa</i>			1			2			
<i>Obliquaria reflexa</i> (JV)			1	4		FD			
<i>Pleurobema atearni</i> (UR)		R							R
<i>Pleurobema decisum</i> *(JV)		34	13	16	2	FD			
<i>Pseudodontoideus connasaugaensis</i>									
<i>Pychobranchus foremanianus</i> *									
<i>Quadrula rumphiana</i>		WD	1	1	1	1			
<i>Tritogonia verrucosa</i> (JV)		18	10	12	6	FD			1
<i>Utterbackia imbecillis</i>									
<i>Villosa nebulosa</i> (JV)									
<i>Villosa umbrans</i> (JV)									
<i>Villosa vibex</i>									
<i>Campeloma regulare</i>								L	L
<i>Elimia capillaris</i>		L							
<i>Elimia carinifera</i>							L		
<i>Elimia carinocostata</i>							L	L	L
<i>Elimia modesta</i>		L	L					L	L
<i>Laevapex fuscus</i>		L	L						
<i>Physella</i> sp.									
<i>Pleurocera</i> sp. cf. <i>vestita</i>		L	L	L	L			L	L
<i>Somatogyrus</i> sp.									
Search Time (person hours)		1.7	1.5	1.2	0.7	1.2	0.1	0.5	0.7
Total number of mussels		80	62	112	9	6	0	0	1
CPUE		48.0	41.3	96.0	13.5	5.1	0.0	0.0	1.5
Total mussel species(L,FD)		5	8	6	5	6	0	0	1
Total gastropod species (L,FD)		4	3	1	1	0	2	4	4
Historic species(L, FD, WD, & R)		13	11	8	6	9	2	4	6

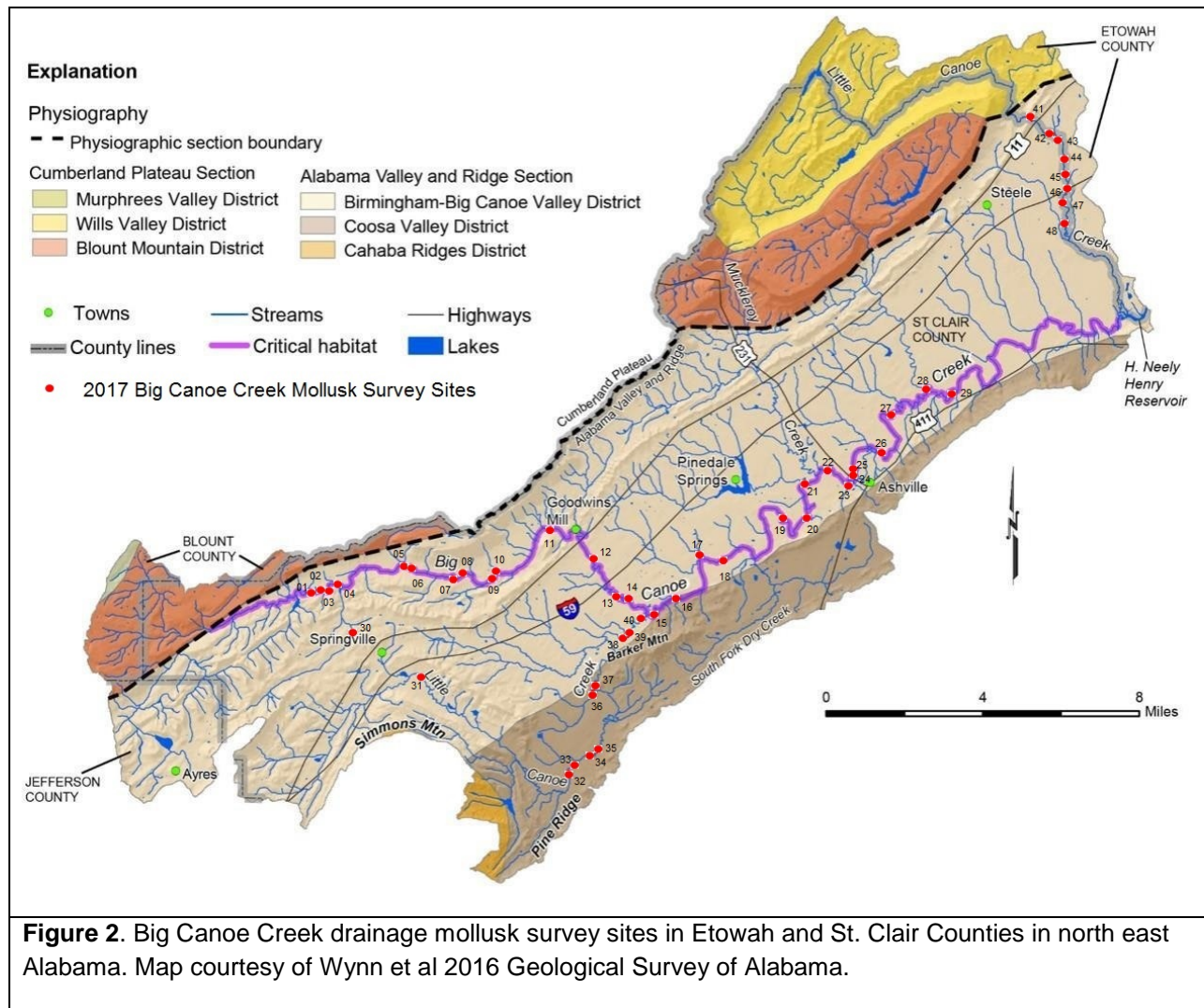
Table 7 cont.

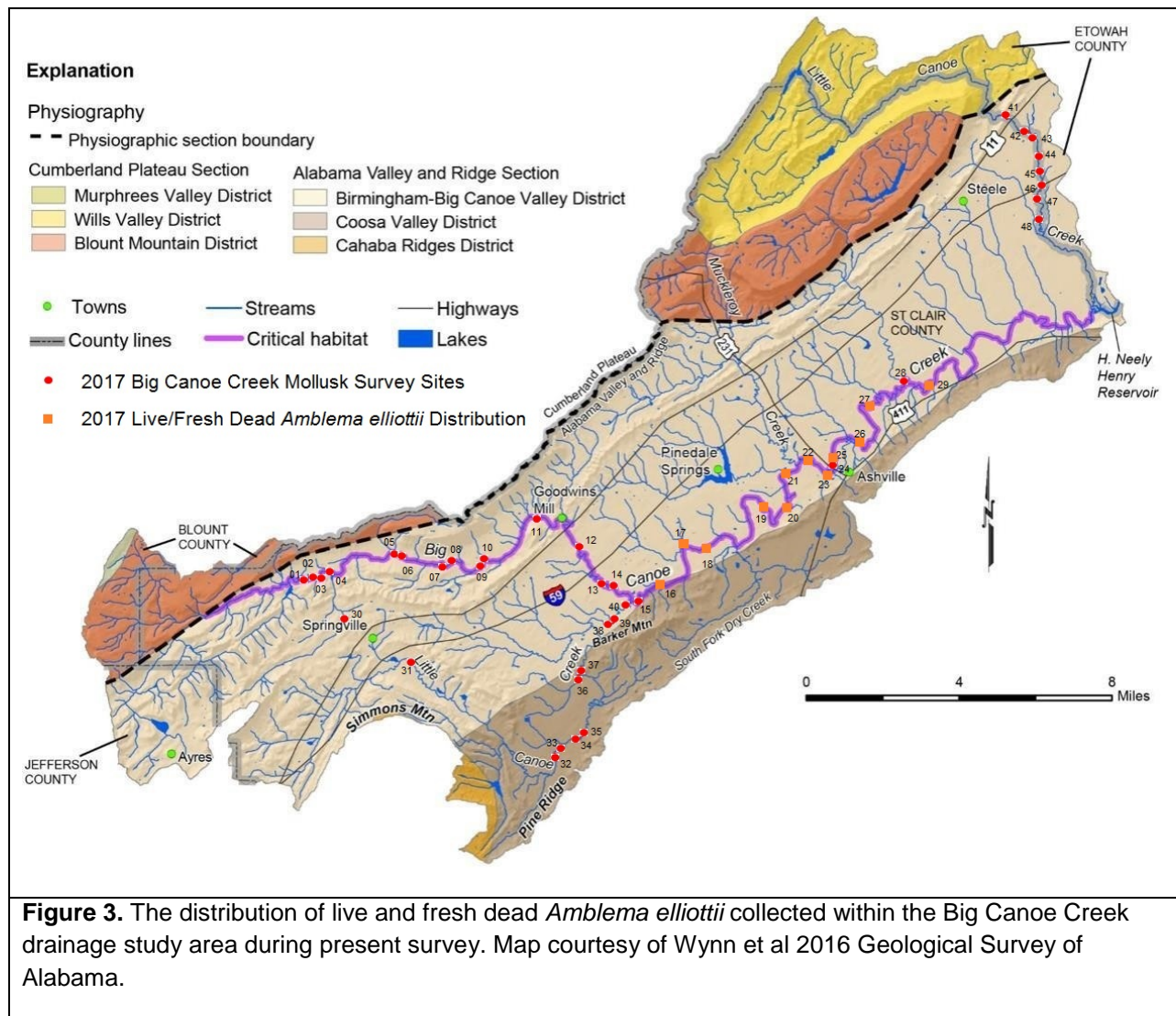
Species	Site (BCC)	UL33	UL34	UL35	UL36	UL37	UL38	UL39	UL40
<i>Amblema elliotii</i> (JV)									
<i>Elliptio arcata</i>									
<i>Hamiota altilis</i> *(JV)								1	2
<i>Lampsilis ornata</i> (JV)					R				
<i>Lampsilis teres</i>									
<i>Lasmigona alabamensis</i>									
<i>Lasmigona etowaensis</i> (JV)									
<i>Leptodea fragilis</i> (JV)									
<i>Ligumia recta</i>									
<i>Megaloniaias nervosa</i>									
<i>Obliquaria reflexa</i> (JV)									
<i>Pleurobema atearni</i> (UR)		R	R	R	R				
<i>Pleurobema decisum</i> *(JV)									WD
<i>Pseudodontoideus connasaugaensis</i>									
<i>Ptychobranthus foremanianus</i> *								R	WD
<i>Quadrula rumphiana</i>									
<i>Tritogonia verrucosa</i> (JV)					R		8	8	1
<i>Utterbackia imbecillis</i>									
<i>Villosa nebulosa</i> (JV)									
<i>Villosa umbrans</i> (JV)			WD	FD					
<i>Villosa vibex</i>									
<i>Campeloma regulare</i>									
<i>Elimia capillaris</i>									
<i>Elimia carinifera</i>									
<i>Elimia carinocostata</i>		L	L			L			L
<i>Elimia modesta</i>		L	L			L			L
<i>Laevapex fuscus</i>									
<i>Physella</i> sp.									
<i>Pleurocera</i> sp. cf. <i>vestita</i>		L	L			L			L
<i>Somatogyrus</i> sp.									
Search Time		0.5	1.5	0.5	0.5	0.5	1.0	1.0	1.0
Total number of mussels		0	0	0	0	0	8	9	3
CPUE		0.0	0.0	0.0	0.0	0.0	8.0	9.0	3.0
Total mussel species(L,FD)		0	0	1	0	0	1	2	2
Total gastropod species (L,FD)		3	3	0	0	3	0	0	3
Historic species(L, FD, WD, & R)		4	5	2	3	3	1	3	7

Table 7 cont.

Species	Site (BCC)	LL41	LL42	LL43	LL44	LL45	LL46	LL47	LL48	Survey Totals
<i>Amblema elliotii</i> (JV)										152
<i>Elliptio arcata</i>										R
<i>Hamiota altilis</i> *(JV)										6
<i>Lampsilis ornata</i> (JV)										20
<i>Lampsilis teres</i>										FD
<i>Lasmigona alabamensis</i>										WD
<i>Lasmigona etowaensis</i> (JV)										1
<i>Leptodea fragilis</i> (JV)										6
<i>Ligumia recta</i>										R
<i>Megaloniais nervosa</i>										3
<i>Obliquaria reflexa</i> (JV)										6
<i>Pleurobema atearni</i> (UR)					R				1	10
<i>Pleurobema decisum</i> *(JV)									R	103
<i>Pseudodontoideus conmasaugaensis</i>										2
<i>Ptychobranchus foremanianus</i> *										2
<i>Quadrula rumphiana</i>										6
<i>Tritogonia verrucosa</i> (JV)									2	166
<i>Utterbackia imbecillis</i>										WD
<i>Villosa nebulosa</i> (JV)										1
<i>Villosa umbrans</i> (JV)		1	FD		FD				FD	7
<i>Villosa vibex</i>										7
<i>Campeloma regulare</i>		L		L						L
<i>Elimia capillaris</i>										L
<i>Elimia carinifera</i>				L					L	L
<i>Elimia carinocostata</i>		L		L			L		L	L
<i>Elimia modesta</i>		L		L			L		L	L
<i>Laevapex fuscus</i>										L
<i>Physella</i> sp.										L
<i>Pleurocera</i> sp. cf. <i>vestita</i>		L		L			L		L	L
<i>Somatogyrus</i> sp.										L
Search Time		1.5	0.5	0.5	0.8	0.5	0.2	0.5	2.5	45.4
Total number of mussels		1	0	0	0	0	0	0	3	497
CPUE		0.7	0.0	0.0	0.0	0.0	0.0	0.0	1.2	10.9
Total mussel species(L,FD)		1	0	0	0	0	0	0	3	17
Total gastropod species (L, FD)		4	0	5	0	0	3	0	4	9
Historic mollusk species(L, FD, WD, & R)		5	0	5	0	0	3	0	7	30







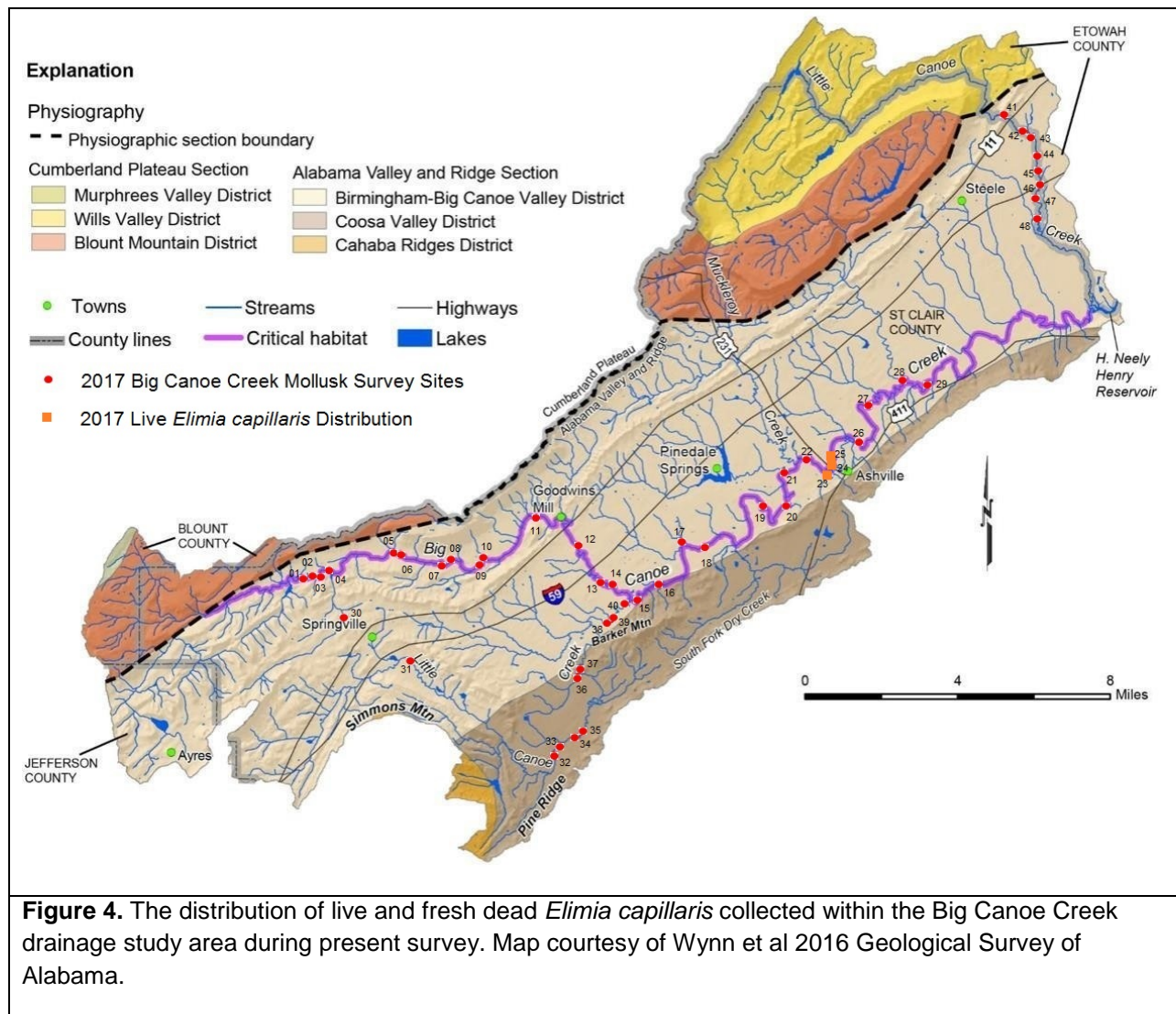


Figure 4. The distribution of live and fresh dead *Elimia capillaris* collected within the Big Canoe Creek drainage study area during present survey. Map courtesy of Wynn et al 2016 Geological Survey of Alabama.

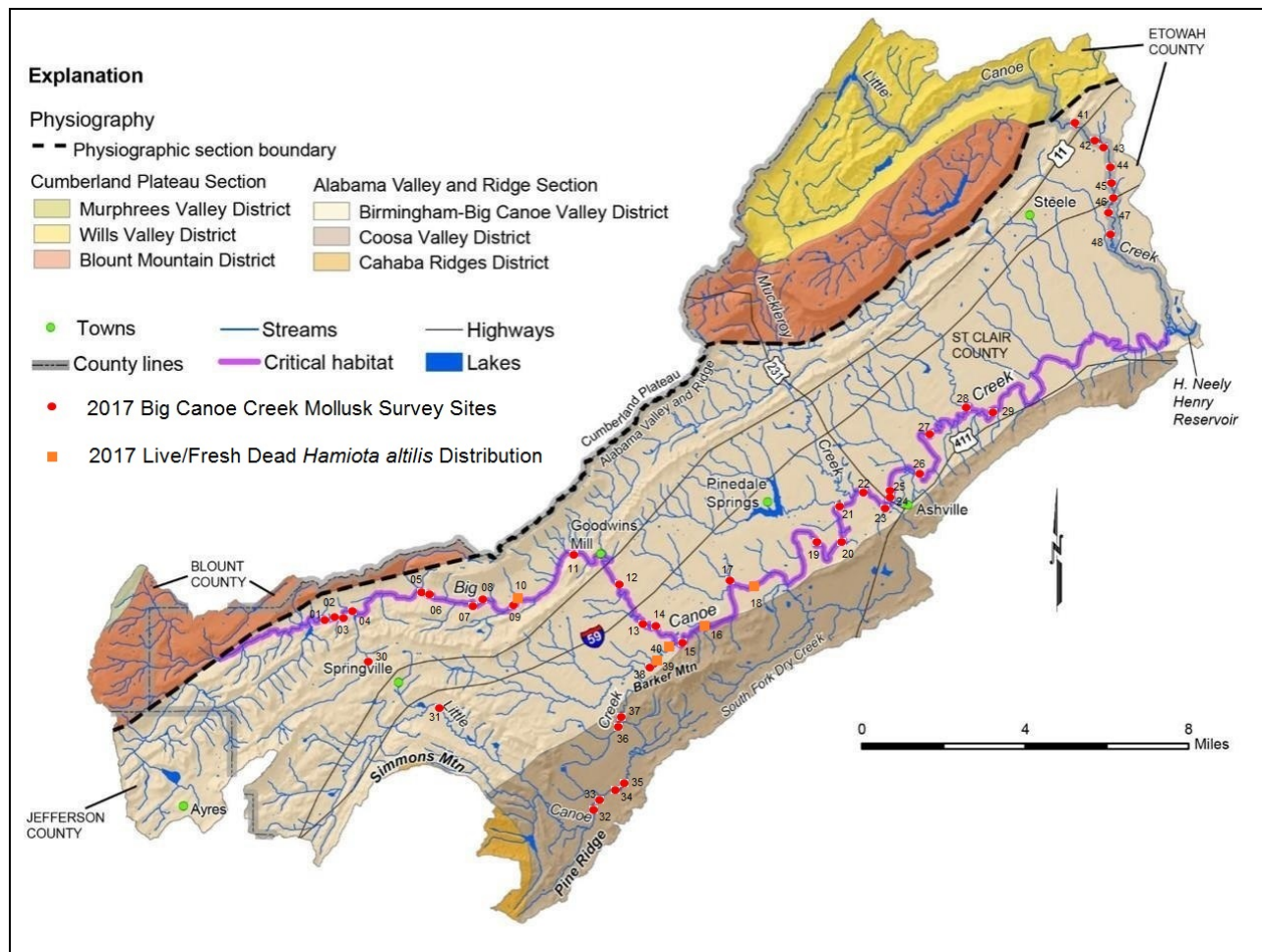


Figure 5. The distribution of live and fresh dead *Hamiota altilis* collected within the Big Canoe Creek drainage study area during present survey. Map courtesy of Wynn et al 2016 Geological Survey of Alabama.

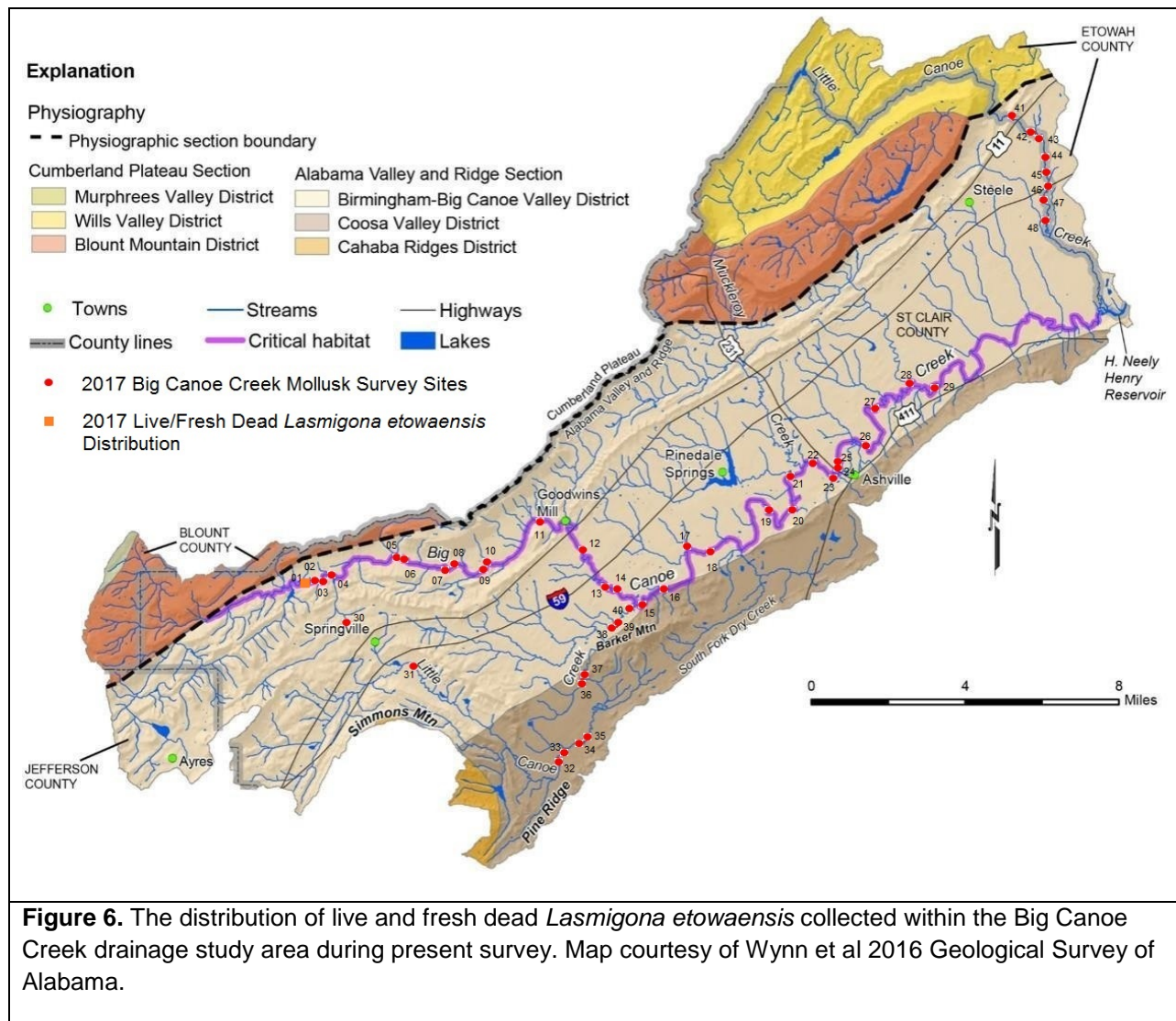
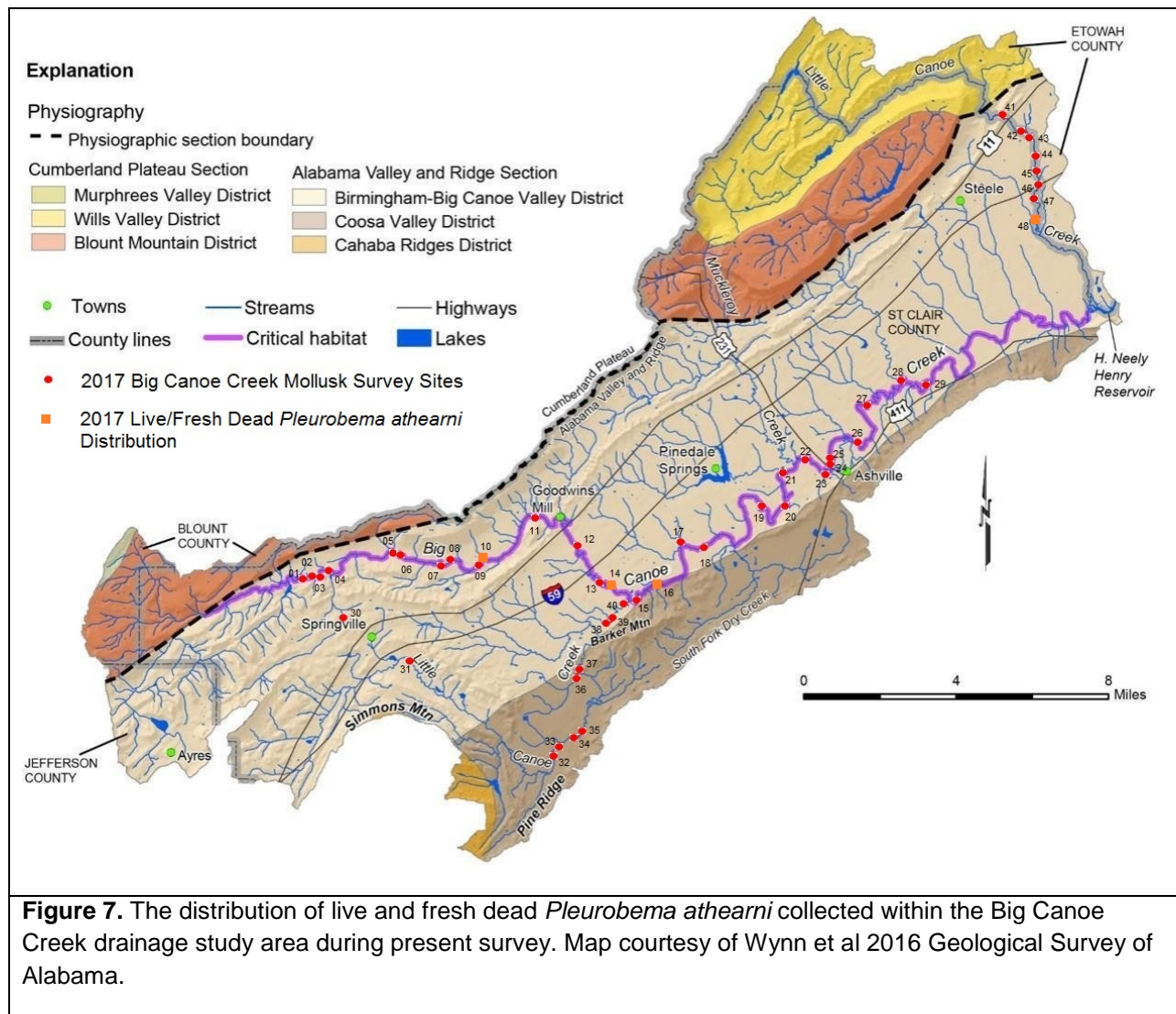
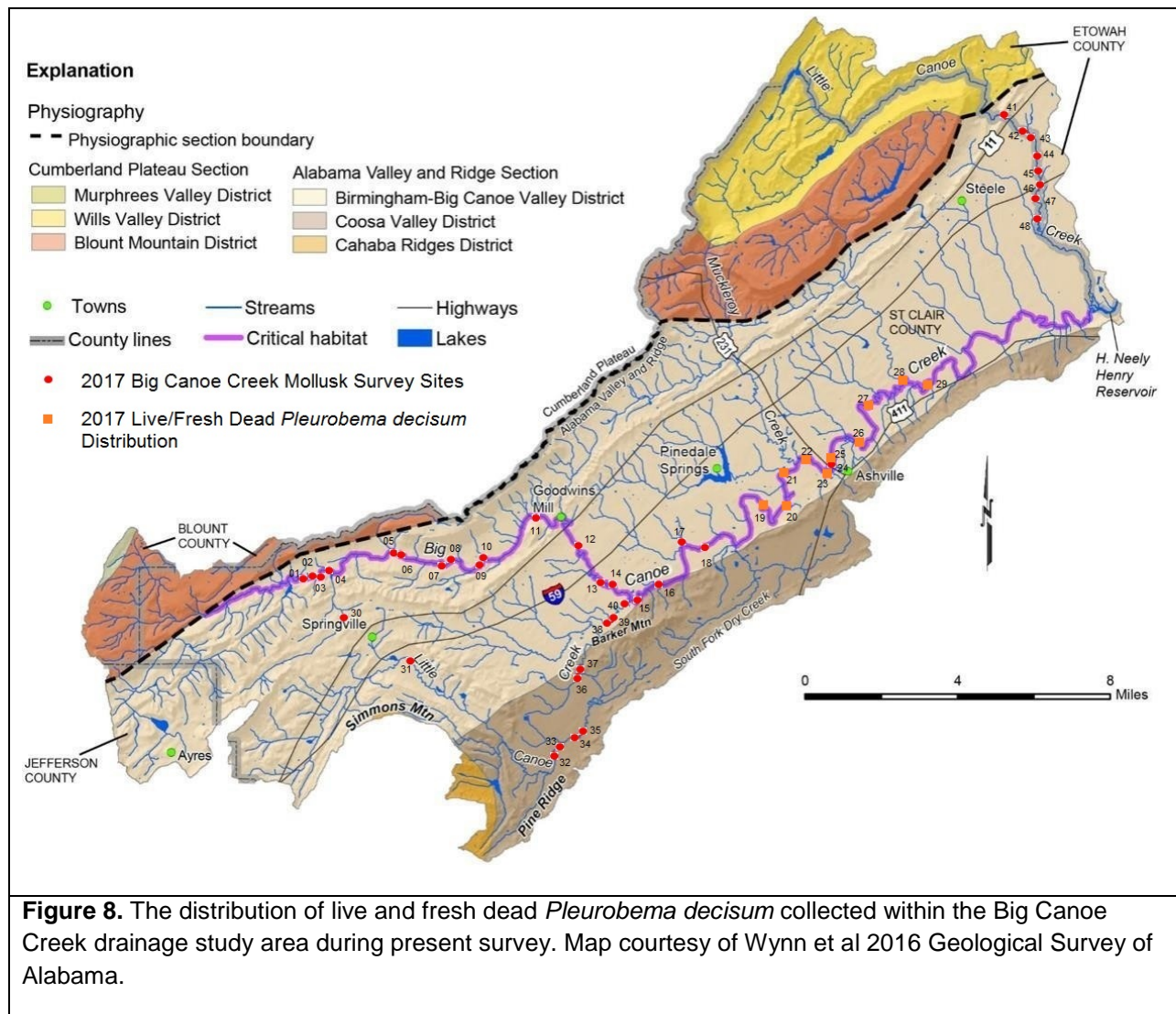


Figure 6. The distribution of live and fresh dead *Lasmigona etowaensis* collected within the Big Canoe Creek drainage study area during present survey. Map courtesy of Wynn et al 2016 Geological Survey of Alabama.





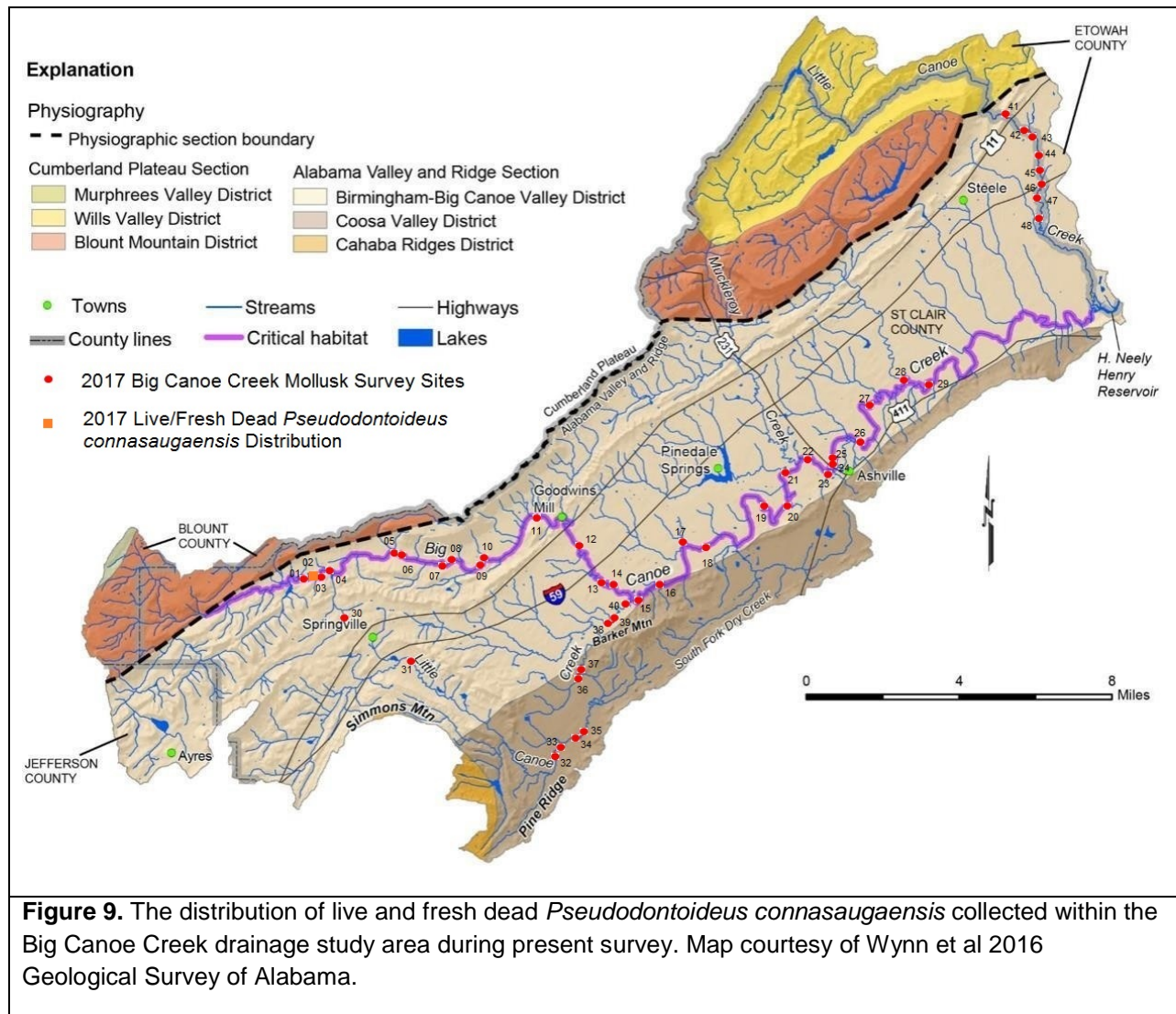


Figure 9. The distribution of live and fresh dead *Pseudodontoideus connasaugaensis* collected within the Big Canoe Creek drainage study area during present survey. Map courtesy of Wynn et al 2016 Geological Survey of Alabama.

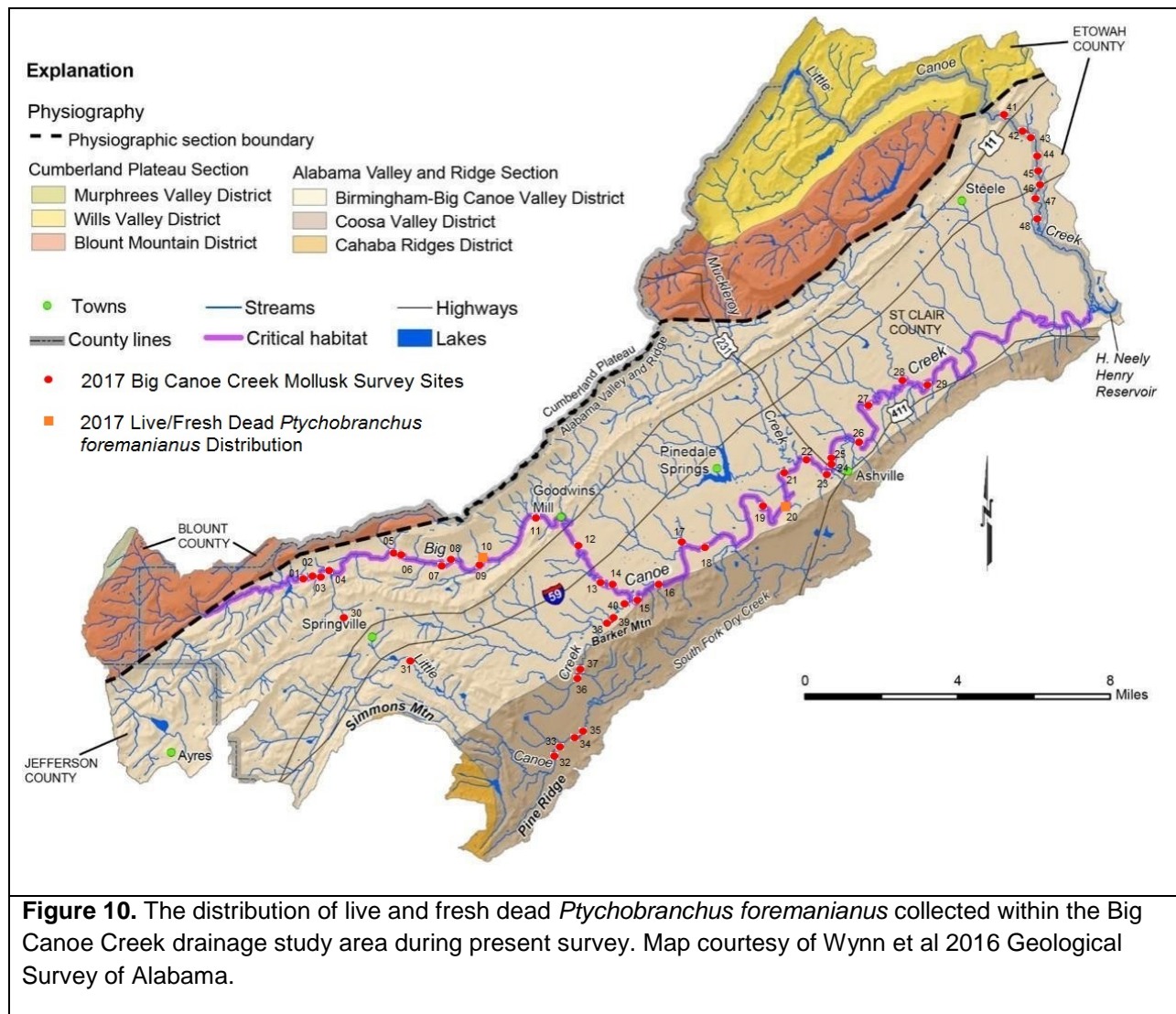


Figure 10. The distribution of live and fresh dead *Ptychobranthus foremanianus* collected within the Big Canoe Creek drainage study area during present survey. Map courtesy of Wynn et al 2016 Geological Survey of Alabama.